SDWG – Gross vs Net LULCC investigation

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SDWG Gross vs Net LULCC Computing Project

The project is investigating the global and regional effects of gross versus net land use and land cover change (LULCC) on climate and the carbon cycle in CLM5 and CESM2.

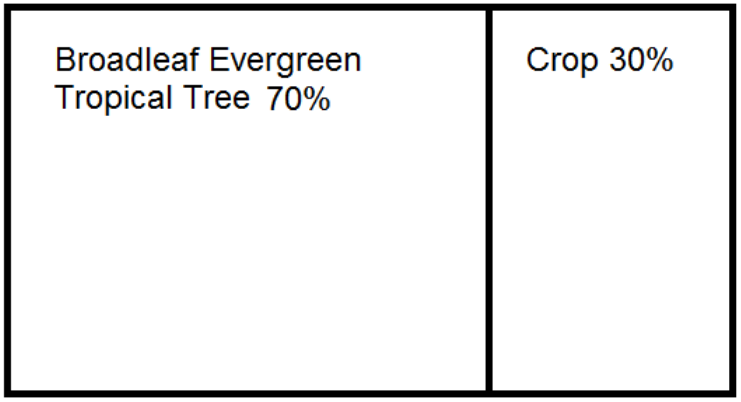
The simulations are an extension to the CMIP6 scenarios for SSP1-2.6 and SSP3-7, generated by the Land Use (LUMIP) and Scenario (ScenarioMIP) projects.

For each scenario (and the historical period), the results of CESM simulations with full Gross LULCC will be compared to CESM experiments with Net LULCC. The Net LULCC experiments will be performed by NCAR for CMIP6 and LUMIP.

Land Surface Data Sets with Net as well as Gross LULCC have been now been developed in this project for CLM5. Waiting for completion of CESM 2.0 and CMIP6 simulations to start experiments.

CMIP6 Gross versus Net LULCC in CLM5 – Shifting Cultivation

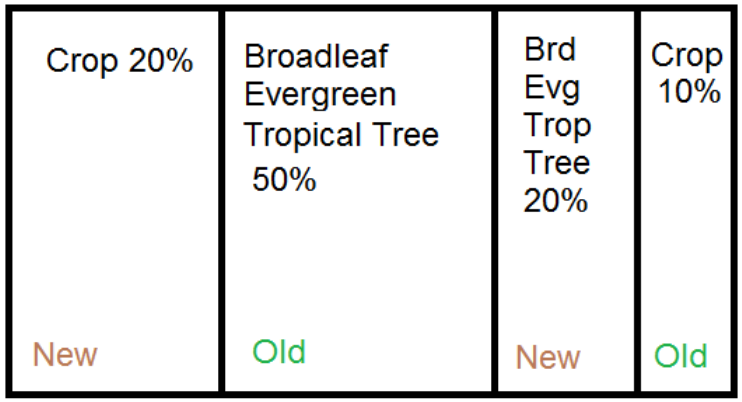
Initial State Yr 1.



Gross Transitions
1. Broadleaf Evergreen Tropical Tree -> Crop 20%
2. Crop -> Broadleaf Evergreen Tropical Tree 20%

Net Transitions:
0% Change

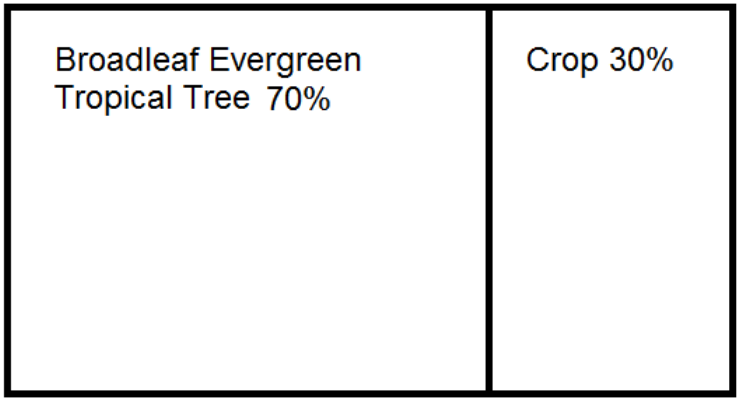
Updated State Yr 2.



In Net Land Cover Change
No PFT fraction changes
therefore no Land Cover
Conversion flux

CMIP6 Gross versus Net LULCC in CLM5 – Shifting Cultivation

Initial State Yr 1.

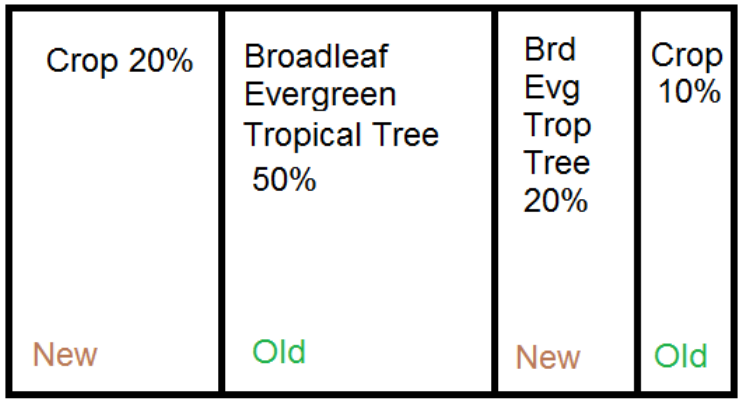


Gross Transitions
1. Broadleaf Evergreen Tropical Tree -> Crop 20%
2. Crop -> Broadleaf Evergreen Tropical Tree 20%

Net Transitions:
0% Change

Unrepresented Gross Transitions:
BET 20% Crop 20%

Updated State Yr 2.



Even though there are no Net Transitions we can still remove vegetation biomass for the Unrepresented Gross Transition area. Additional LULCC fluxes done in the same manner as wood harvest

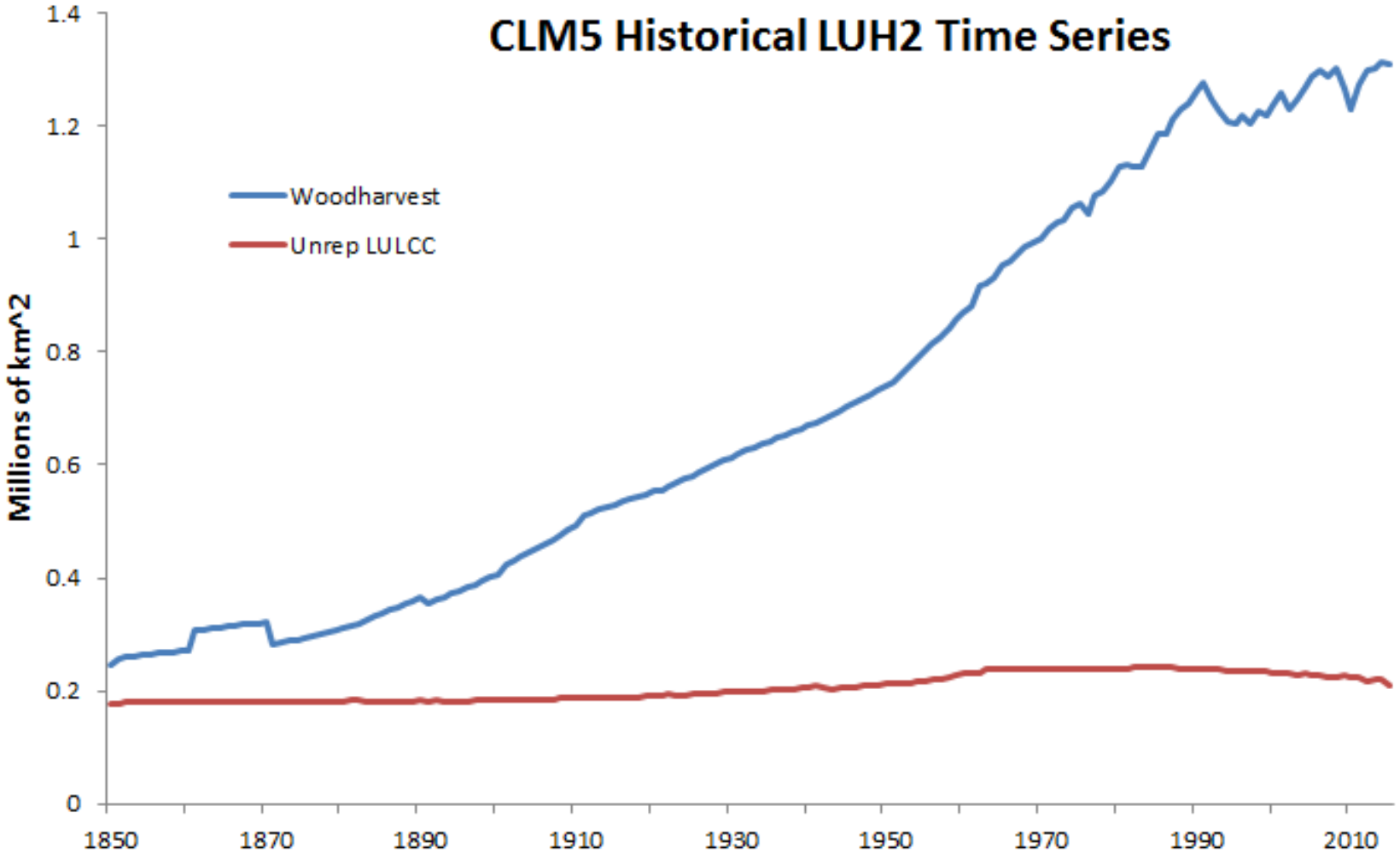
3. CMIP6 LUMIP CLM5

1. Working with Dave Lawrence, Bill Sacks and Danica Lombardozzi developing new LUMIP CMIP6 CLM transient crop simulation capability with prescribed annual crop N fertilizer and irrigation. New landuse.timeseries files.

For each year of LUMIP/CMIP6 time series specify for each grid cell:

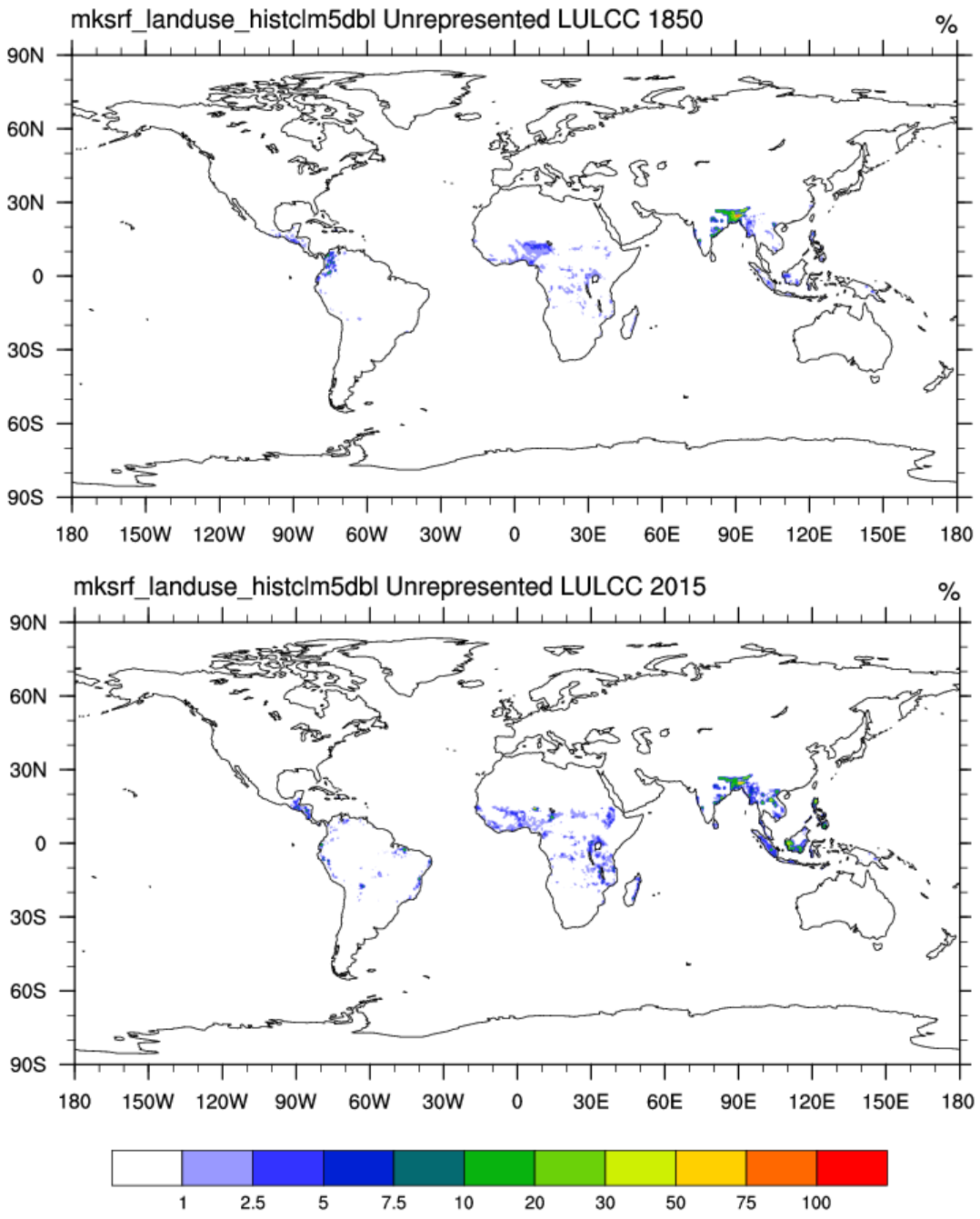
- PCT_NATVEG – percent of gridcell as natural vegetation land unit
- PCT_CROP – percent of gridcell as crop land unit
- PCT_NAT_PFT – percent of natural vegetated land unit for each PFT
- PCT_CFT – percent of crop land unit for each CFT (irrigated/rainfed)
- FERTNITRO_CFT – gN/m2/yr N Fertilizer for each CFT
- HARVEST_PRIMARY_FOR – gC/m2/yr Wood harvest Primary Forest
- HARVEST_PRIMARY_NFOR – gC/m2/yr Wood harvest Primary Non Forest
- HARVEST_SECONDARY_MFOR – gC/m2/yr Wood harvest Second Mature For
- HARVEST_SECONDARY_YFOR – gC/m2/yr Wood harvest Second Young Forest
- HARVEST_SECONDARY_NFOR – gC/m2/yr Wood harvest Second Non Forest
- UNREPRESENTED_PFT_LULCC – percent of PFT unrepresented in Net LULCC
- UNREPRESENTED_CFT_LULCC – percent of CFT unrepresented in Net LULCC

CMIP6 Unrep Gross versus Wood Harvest CLM5

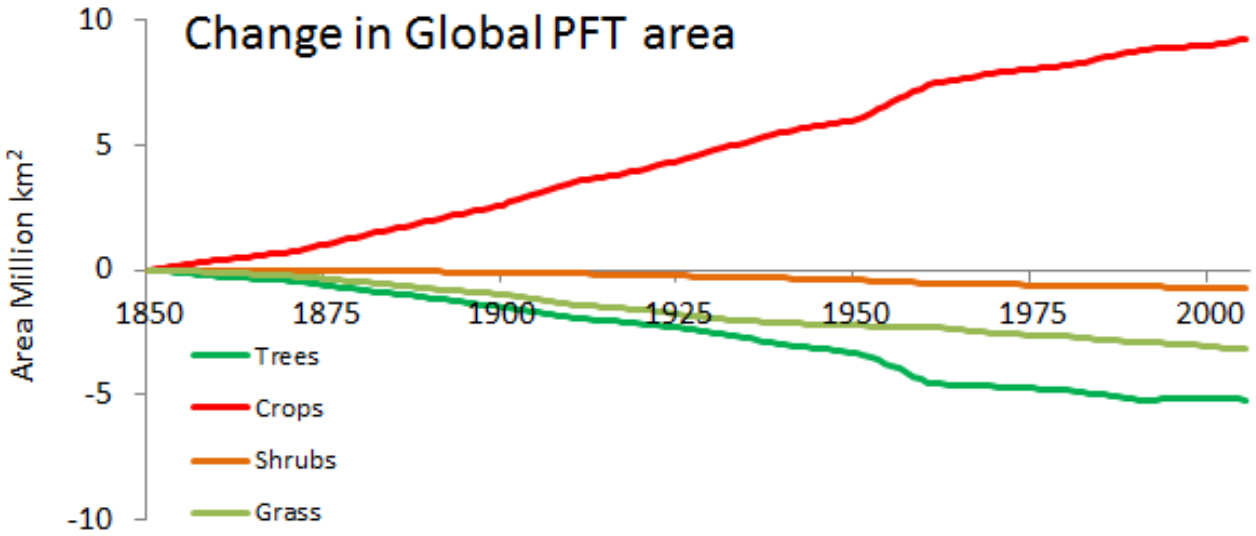


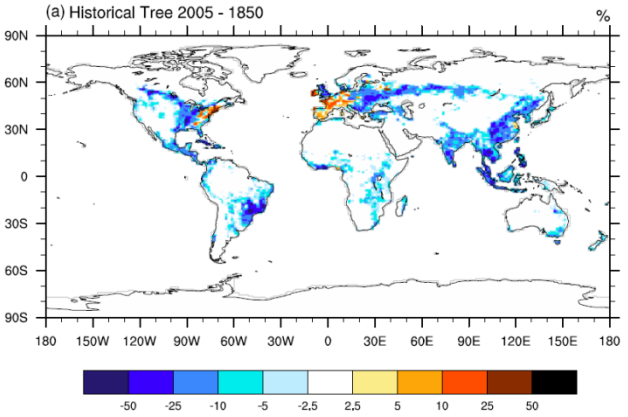
CMIP6 Unrep Gross LULCC

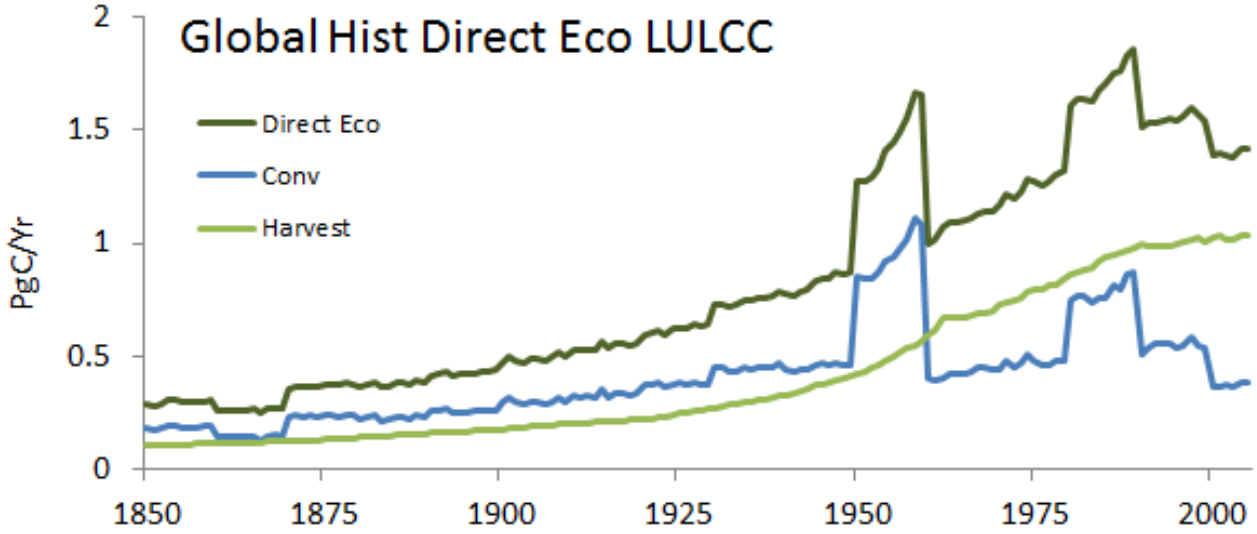
CLM5 CMIP6

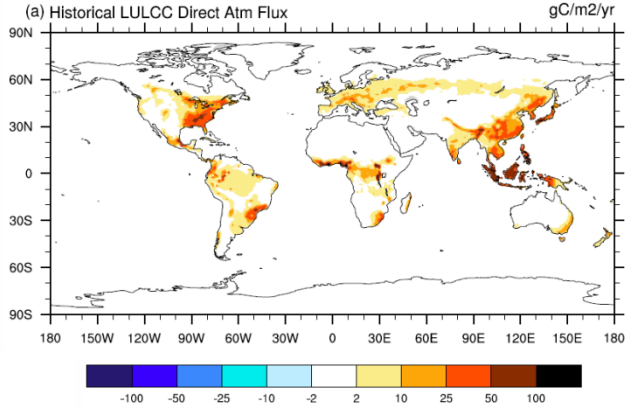


CMIP5 Historical Direct LULCC Fluxes









$LULCC_{DIRECT\ ECO}$ = Conversion + Wood Harvest = 126.8 PgC (PgC = 10^{15})

Conversion = 63.2 PgC Wood Harvest = 63.6 PgC